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Final Technical Report "Advanced Instrumentation for Optical Sensor Arrays"

Grant #N0014-95-1-0295

Principal Investigator: Dr. David R. Walt

Co-Principal Investigator: Dr. John Kauer

Institution: Tufts University

Award Period: 1 January 1994-30 November 1995

The instrumentation purchased on this award has enhanced the research presently funded on a grant from the Office of Naval Research, #000014-94-1-0312. The instrumentation purchased has provided a significant enhancement to the existing instrumentation in the laboratories of the principal investigators. Two complete fluorescence illumination and detection systems including custom-designed horizontally mounted microscopes, CCD cameras, state-of-the-art filtering and spectral scanning components and positioning stages were assembled. One instrument is located in the laboratory of Dr. Walt on the Medford campus; the other instrument is in the laboratory of Dr. Kauer at Tufts Medical School. These instruments have dramatically improved the ability of the investigators to carry out the ONR supported work on sensor arrays. The computational capabilities of the laboratories has also been enhanced with the purchase of several Macintosh Quadra-computers and two computers with UNIX operating systems. These computers have enabled us to acquire and process images as well as feed information into a neural network to train it to recognize complex patterns emanating from the sensor arrays. A Nanoscope-3 scanning force microscope has been purchased from Digital Instruments. This instrument has dramatically enhanced our ability to characterize the surfaces of sensors in order to develop stable adhesive polymeric materials as sensor coatings. The other major piece of equipment purchased is a BIAcore instrument from Pharmacia Biosensor. This instrument was purchased through a combination of the BURIP award and institutional funding. The instrument has been of great value in assessing antibody-antigen binding interactions, including their kinetics,

so that appropriate monoclonal antibodies can be selected for use with sensors. A complete photo-deposition system has also been assembled, enabling state-of-the-art polymer photo-processing to be accomplished. This system will be extremely useful for precisely positioning sensors on the tips of optical imaging fibers. Smaller pieces of equipment purchased through this award include a manifold freeze dryer for antibody preparation, and two olfactometers for presenting airborne analytes to the sensor in controlled reproducible form. Both laboratories at Tufts are now in a unique position to not only prepare sensors, but analyze them from the perspective of both materials characterization and spectral performance.